

Excerpted from

IT's Elementary!

Integrating Technology in the Primary Grades

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Good integration of technology with content knowledge changes instruction. The more technology tools you put in the hands of students and teachers, the more technology becomes a natural expression of their thinking. Even on a shoestring budget, an effective integrated technology program is possible in the primary grades. Let instructional technology specialist Boni Hamilton show you how.

The following excerpt discusses specific strategies for effectively incorporating technology in the elementary classroom.



Chapter 1

The Philosophy of Integration

AFTER MORE THAN TWENTY YEARS OF COMPUTERS IN SCHOOLS, technology integration in education should be ubiquitous and no one should need to write a book about it. After all, technology has infiltrated all aspects of our daily life, and we rarely even notice it. Yet, teachers still talk about “doing a technology lesson” as though teaching with technology is somehow different from “real” teaching. After all this time, the process of integrating technology with content area instruction remains a mystery to many teachers.

WHY INTEGRATE?

I believe that *the integration of technology with classroom content improves student achievement*. Thoughtfully planned, such lessons engage students to a higher degree than traditional teaching and lead to the development of 21st-century skills such as complex thinking, creative problem solving, and collaboration.

Not everyone agrees that technology integration improves student learning. Some argue that research results have been mixed, and they are correct. Yet, overall, the evidence seems to support the belief that appropriate use of technology results in higher student achievement and involvement.

Creating a definitive research study to measure the effectiveness of technology integration has serious challenges. First, technology includes many devices beyond the computer: digital cameras, the Internet, student information systems, multi-media devices, LCD projectors, and a plethora of other tools. Then too the tools may be used in multiple ways: programmed learning, skills in isolation, project-based learning, simulations, tutorials, multimedia presentations, video conferencing, etc. Narrowing the scope of a research study to only one technology tool and one technique eliminates the central component of integration—the infusion of many forms of technology into content-area instruction to meet the diverse needs of students.

The evidence that convinced me about the effectiveness of technology integration was data analysis at Lenski. When I looked at data concerning students' academic growth, based on state, national, and school-based assessments, I found that students' academic growth was significantly higher in classes where teachers used technology widely. Other factors such as teacher skill, student mix, and parental participation may have also influenced achievement in these classes, but students cited the frequent use of technology as a motivator in their classes.

Lenski's data also contrasted sharply to surrounding schools on the issue of gender differences. While many schools scrambled to address significant gender gaps in reading, writing, and math, Lenski consistently showed no gender gaps in any of those areas over six years except for a couple of years in third-grade writing. Third-grade boys lagged behind girls in writing performance on state tests, but made up the gap by the fourth-grade tests. Lenski staff believes that the use of technology mitigates gender differences.

WHAT IS INTEGRATION?

To clarify what the term integration means, one must first understand what it does NOT mean. Integration is NOT the use of managed instructional software, where a computer delivers content and tracks students' progress. Integration is NOT having students go to a computer lab to learn technical skills while the classroom teacher stays behind to plan or grade papers. Integration is NOT using the Internet to access games sponsored by toy manufacturers or popular television shows. Integration is NOT using specialty software for drill and practice day after day. Integration does NOT replace a teacher with a computer.

Integration is when classroom teachers use technology to introduce, reinforce, extend, enrich, assess, and remediate student mastery of curricular targets.

Integration is an *instructional choice* that generally includes collaboration and deliberate planning—and *always* requires a classroom teacher's participation. It cannot be legislated through curriculum guides nor will it happen spontaneously. Someone with vision—an administrator, a teacher, or a specialist—needs to model, encourage,



RESEARCH ON THE EFFECTIVENESS OF TECHNOLOGY INTEGRATION

In 1996, Stratham and Torell reviewed 10 meta-analyses on how technology impacts student learning. They found that computer technology, when implemented properly, could profoundly impact student learning.

They reported the following findings:

- Student performance on tests: “When properly implemented, the use of computer technology in education has a significant positive effect on student achievement as measured by test scores across subject areas and with all levels of students.” (Stratham & Torell, 1996.)
- Impact on classroom instruction: “When used appropriately, computer technology in classrooms stimulates increased teacher/student interaction, and encourages cooperative learning, collaboration, problem-solving, and student inquiries.” (Stratham & Torell, 1996.)

Both of these findings indicate how important it is for teachers to be thoughtful about the implementation of technology use in the classroom. The second finding also highlights how appropriate use of technology in a classroom can change teaching practices.

- Impact on student behavior: “Students from computer-rich classrooms show better behavior, lower school absentee rates, lower drop-out rates, earn more college scholarships, and attend college in greater numbers than do students from non-computer classrooms.” (Stratham & Torell, 1996.)

This finding seems to support increasing students’ access to computers in the classrooms. At Lenski, a computer-to-student ratio of 1:2.5 allowed teachers and students to accomplish their work without frustration, even though some of those computers in the ratio were reserved for adult-only uses such as the library check-out system and administrator computers.

- Impact of computer use on subgroups: “Computer-based teaching is especially effective among populations of at-risk students.” (Stratham & Torell, 1996.)

At-risk students not only have barriers to their learning, but they often struggle with confidence as well. At Lenski, at-risk students build confidence as they master computer skills and coach classmates.

For those who need more repetition of basic skills than their classmates, we often can find Web-based practice drills that they can use at home or during free time at school. Drills don’t seem onerous when students are setting their own pace and interacting with a computer.

A literature review by James A. Kulik in 2003 compared meta-analyses of research prior to and after 1990. He concluded that, although the research was at times contradictory, overall, instructional technology is growing increasingly effective at the elementary and secondary levels (Kulik, 2003). This finding seems to acknowledge that over the past decade teachers have had access to more equipment, Internet-based resources, and lesson ideas than in the early years of computer use.



and enable integration, but only a classroom teacher can integrate technology with content-area teaching.

Can a classroom teacher integrate technology without collaboration? Definitely! Some teachers infuse technology into their classroom instruction without involving anyone else. Whether their students use technology in the classroom, a lab, or the library, the teacher takes full responsibility for planning, monitoring, and assessing the lessons. However, the likelihood of consistent, persistent, and purposeful integration increases dramatically when classroom teachers include others in their instructional plans.



FIGURE 1.1 First-grade teacher Diane Vyhnaek is always looking for new ways to engage her students in discovery and higher-level thinking. Here she uses a document camera and projector to look closely at dragonflies in different stages of the life cycle.

Can a computer teacher, even a master teacher, integrate technology with classroom content without the involvement of a classroom teacher? **No!** Not even if the computer teacher knows the curriculum better than the classroom teacher. No one but the classroom teacher has the knowledge of where the students are in their mastery of a concept and what curricular targets need reinforcement or assessment. Every class is different with different needs.

Even though all four first-grade classes at Lenski study insects, how the teachers use technology to support the unit differs widely from one another and from year to year. One teacher combines insect study with independent research. Students read about insects and write simple reports. On the computers, they illustrate their reports with drawings of the insects. Another class focuses on recognizing insect body parts. They visit Web sites where they can practice identifying insect body parts and culminate their unit with detailed, labeled insect drawings generated on the computer. Another teacher focuses on habitats, so her students' labeled

drawings include the insects' habitats. The fourth teacher combines insect study with observation, questioning, and inferential thinking. Using a Web site with hundreds of photos of dragonflies, she and the students link what they see in the photos to what they've read about dragonflies. They engage in rich conversations about all aspects of dragonflies' lives, including speculating about why some wings have missing pieces and why different species of dragonflies have different coloration. During this dragonfly study, the students scramble to find information that will answer their questions until they are experts on dragonflies. They then apply what they've learned about one insect to the general category of insects.

The computer teacher can address curriculum through technology, teach rich lessons on curricular units, deliver instruction that helps students meet state or national standards, and affect students' academic progress overall. But, without the involvement of the classroom teacher, the lessons in a computer lab are supplemental, not integrated.

The classroom teacher provides the link between the technology project and classroom learning. Prior to lab sessions, the classroom teacher identifies where students are in their mastery of curricular targets and suggests areas where students need reinforcement. This knowledge drives the design of lessons.

The classroom teacher also ties technology lessons to classroom experiences through examples, references to classroom conversations, or pre-instruction. The teacher clarifies vocabulary, expectations for finished products, and timelines. Without the involvement of the classroom teacher, computer lessons stand alone.

Many computer teachers and paraprofessionals teach stand-alone lessons that tie into curricular objectives. Their lessons are well conceived and expertly taught. This *parallel teaching* supplements classroom instruction because it reinforces essential knowledge and, at the same time, teaches essential skills for a technology-based future. While parallel teaching supports students academically, it doesn't link as tightly to their classroom learning as a lesson conceived by and co-taught by the classroom teacher.

In thousands of other computer labs though, the lessons have no connection to curricular content. In this model of *isolated teaching*, computer teachers simply create projects that use the computer skills they believe students should know or send students to game sites with little educational tie-in. Often, these isolated lessons are simply play times for children.

If, when teachers are using technology to support content-area instruction, they also follow best instructional practices for improving student achievement, their students are highly likely to become better readers, writers, mathematicians, scientists, and thinkers.

Consider how the use of technology connected to content-area instruction can incorporate the nine instructional strategies that have a positive effect on student learning (Marzano, Pickering, & Pollock, 2001):

- Identifying similarities and differences. At any grade level, teachers can use technology to help children compare and contrast, classify, or link information. While Venn diagrams probably come to mind first, students can identify similarities and differences through other computer tasks. They can draw pictures that illustrate similarities and differences in content-area units such as seasons, insect body parts, and planets. Writing similes and metaphors requires

students to make connections between two unlike things. Students can even draw illustrations of analogies within poems or work on Web sites where they separate words by initial sounds.

- **Summarizing and note taking.** When students glean essential information from what they read or hear, they improve their recall of the information. Creating a slide show presentation requires students to distill their information into a few bullet points that will convey their messages. Students can also take two-column notes in a spreadsheet or word processing application.
- **Reinforcing effort and providing recognition.** Students do not always understand that effort pays off. When they set reading goals and then graph the results after a trimester, they can take pride in their accomplishments. Studying famous people who made a difference in the world will highlight for students the connection between effort and recognition. At any grade level, students can create portfolios of their work—periodically looking back at where they started and what they’ve accomplished can motivate students to continue working hard.
- **Homework and practice.** Homework is most effective when students do it without parental involvement. By third grade, students can practice keyboarding independently at home. If students have Internet access, they can use a number of free Web-based keyboarding resources listed in chapter 7. Teachers can also recommend Web-based drill activities to help students master basic skills.
- **Nonlinguistic representations.** Vocabulary words stick when students use drawings as well as definitions. Check out the Dictionary Day and Idiom activities in chapter 9 as good examples of nonlinguistic representation. Even before they can read and write, primary students can express their understanding of curricular targets through pictures. Graphing provides another way for students to understand relationships in numbers.
- **Cooperative learning.** Students in computer-rich classrooms are more likely to use cooperative learning (Stratham & Torell, 1996) to complete their work. Teachers can promote cooperative learning through assigning teams to complete short projects, such as writing dialogue in pairs, or longer assignments, such as researching an aspect of space exploration.
- **Setting objectives and providing feedback.** Having students create their own questions for research projects encourages them to set the objectives for their study. They then can focus on the aspect of curriculum that piques their interest. The use of virtual manipulatives gives students instant feedback on math concepts, as do many other Web sites that engage students in basic skills practice.
- **Generating and testing hypotheses.** Students can predict what will happen when they gather data for graphs, virtually build and test machines online, and solve logic problems on Web sites. Young students can place pictures in sequential order, complete a pattern, or match pictures of bird beaks with food sources.

- **Questions, cues, and advance organizers.** When questions, organizers and other tools are used prior to instruction in a curricular unit, the tools help students identify what is important to remember. Teachers can introduce a unit through wordless slide shows. With a pictures-only slide show, students draw conclusions about the unit from the pictures they see. This also gives them visual anchors for the text they read. Introducing primary source photos and audio clips at the beginning of a unit on immigration or state history, for instance, can help students generate the questions they want to research.

A teacher who can combine these nine strategies that have a positive effect on student learning with curricular content supported by the use of technology will develop rich learning experiences for students and improve achievement.

REQUIREMENTS FOR INTEGRATION

To successfully integrate, schools must have the following resources:

Administrative Support. The role of the administrator cannot be overstated. The integration of technology and library skills (information literacy) must become a non-negotiable within a school or the technology program will never change. Making such a change in a school is not easy and probably cannot be done quickly. A truly supportive administrator ensures that:

1. *Classroom teachers understand the responsibility for planning and teaching content-based technology lessons.* Schools use different models for delivering technology support. In some schools, classroom teachers accompany their students to a lab and co-teach the lesson with a technology teacher. Other schools have eliminated labs and expect all technology use to happen within the classroom. One school, which treats computer lab as part of the specials rotation, changed its delivery model so that classroom teachers pre-teach the technology lesson in the classroom and the technology aide assists students when they work in the lab.
2. *The school is staffed with professional library and technology staff.* If a district already provides the funds to hire professionals in these roles, then those schools have an advantage. However, in many schools, the library and technology positions are filled with teacher assistants, who, despite their excellent intentions, often do not have the knowledge base or staff development opportunities to become instructional leaders. Professionals in these areas can model lesson design, collaboration, and instruction.

Lenski has opted to increase class size slightly and use the extra staffing dollars to pay for full-time professional support in the library and lab. The district's average class size is 25, but, at Lenski, 25 is the minimum, with a maximum of 29 students. The community and staff know that the support from the professional library and technology staff helps teachers during important instructional times.

3. *Computer teachers are treated as colleagues with professional status, regular planning time, and staff development opportunities.* Asking teachers to co-plan and co-teach with classified staff often backfires because of the difference in training and status. Computer teachers need to attend the same staff development as the classroom staff. Then they can use the same instructional methods and language as classroom teachers so that students hear consistent messages. Additionally, administrators should consider placing their strongest instructional models in the library and computer lab. In a strong library/technology program, these two support teachers model instruction for all students and all classroom teachers. In fact, because of their regular work with all students, the library/tech staff may actually be better at diagnosing when an intervention to address barriers to achievement is needed.
4. *Professional growth plans for classroom teachers include goals related to technology integration.* Initially, teachers should submit at least one lesson plan for a technology-based unit and completed student samples to the principal annually. Eventually, though, technology integration should happen so regularly that such goals can be dropped from the professional growth plan.
5. *All staff receives ample opportunities to learn best practices in technology integration.* This may be the hardest task, in fact, because of a glut of poor models and dearth of excellent models. However, most schools and school districts can identify a few staff members who integrate technology in some aspect of instruction. These teachers can be tapped to either present staff development or host observations in their classrooms. If the school has the capability to videotape teachers using best practices in technology integration, the videos can be used as resources.
6. *Teachers feel safe taking risks.* Integrating technology requires changing how staff members interact, plan, and instruct. Teachers must feel safe and supported while they experiment with change. This may be as simple as allowing a teacher to abandon an idea that doesn't work out or as complex as redesigning the schedule to allow for collaborative planning time.

Staff Buy-in. Some schools ask teachers to manage all the technology use alone. Others, like Lenski, provide support staff to manage the computers, co-teach in a lab, conduct staff development in technology skills, and ease the load of planning technology units. Whatever the school's approach, teachers do not have to be experts in technology in order to integrate it. Often students' technical skills surpass the staff's, and students can coach one another. However, teachers do need to believe that the use of technology will help students reach curricular targets.

The effectiveness of a technology-based unit depends on a teacher's planning. Students' use of computers must be productive, which means it must enhance or reinforce content learning. That may require teachers to observe models of good integration so that they understand how to plan for and use technology. When teachers involve colleagues in their planning, the synergy of collaboration will result in even stronger instructional units.

Time and Tools for Collaboration. Many teachers are accustomed to closing their doors and teaching in isolation. They may plan major units with grade-level peers, but they have little experience co-planning and co-teaching a lesson or unit. Adjusting to team-teaching with the librarian and/or technology teacher may take time. This book offers tools and suggestions for initiating collaboration.

In addition, schools must provide time for collaborative planning. The pioneers, those who embrace change and take risks without fear, will make time, but other teachers may have to be prodded. Administrators can play a critical role by providing time, support, and incentives for collaborative planning. One technique that jump-started a school's program was a small grant that paid grade-level teams to meet one day during the summer with the library and technology staff. They planned major units and talked about possible ways to integrate information literacy skills.

Equipment. Most schools place their emphasis here, but it is the least important resource. Certainly, integration is easier when a teacher has a wealth of technology equipment—imagine the possibilities with a class set of wireless laptops in every room!—but a committed teacher can integrate technology even if only one Internet-ready computer with the basic office software suite is available. Lessons in an equipment-poor environment may not have the same scope, and a teacher may face daunting obstacles, but even in this environment, appropriate use of technology can impact student learning. This book will provide suggestions for how to adapt in an equipment-poor environment and how to acquire equipment.

WHERE TO START

Some schools don't currently have the necessary resources to fully integrate technology with classroom content. Rather than giving up in despair, individuals in schools should start the process of making changes in their areas and invite others to join. No matter what level of influence a person has in a school, everyone can take small steps toward making technology integral to instruction. A small spark may be all a school needs to get the engines going!

ADMINISTRATORS

Administrators who are frustrated by a lack of funds, equipment, teacher buy-in, or even technical support can focus on just one change that will make a difference for the school. Repurposing even a small amount in the budget for a technology purchase can energize a teacher to try a new technique. Perhaps a benefactor can supply a critical piece of equipment or the technology committee can pursue a grant. Hiring a technology integration pioneer for the next classroom opening can provide a model for other teachers. If teachers are required to add technology integration goals to their professional growth plans, they will have an impetus to try something new, especially if the administrator makes it clear that teachers are safe to take risks.

One strategy that has set several schools in motion has been the implementation of a teacher-only technology committee empowered with a budget. When teachers understand the vision for integration and are given money to spend for technology that will move the school ahead, they are motivated to increase their use of technology. The budget doesn't need to be large, but teachers do need the power to make the decisions without being vetoed by an administrator.

Administrators can also encourage teachers by sharing ideas for lessons, gleaned from this book or from an Internet search. One principal sends a new idea monthly to her staff to keep them thinking about how to integrate technology more effectively.

COMPUTER TEACHERS/COACHES

Computer teachers depend on classroom teachers for collaboration. If computer lab is a drop-off special, lab lessons will be examples of parallel teaching. A lab teacher can recruit an approachable classroom teacher to at least co-plan a lesson. It may require the computer teacher to put out 75% of the effort, but once the students have completed a few curriculum-based lessons related to content, other teachers will be curious about how they can help the computer teacher design lessons that support the curriculum for their students. Over time, computer lab teachers can encourage teachers to be more involved in the lab planning.

Three good projects that parallel classroom content may be all a computer teacher can accomplish in a year. However, a project used with one class can generally be adapted to other classes and grade levels so each idea has the potential for lessons in multiple classes.

CLASSROOM TEACHERS

Classroom teachers who lack either the support or time for technology integration can sift through the second half of this book for lesson ideas. For instance, since non-linguistic representation builds students' success in recalling information, a classroom teacher can ask students to use pictures to represent content-area vocabulary. Students will enjoy using the classroom computer(s) to create their illustrations. Displaying their work will improve all students' mastery of the vocabulary. Such a project works for any grade level.

Teachers will experience more success if they limit themselves to simple projects at first and a maximum of three new ideas a year. Each year they can build on the previous year's successes.

I've written this book to convey hope to readers. The integration of technology with classroom content instruction is a journey, not a race. Every step a school takes toward integrating technology more thoughtfully and purposefully will improve instruction for students.

With dozens of sample activities and lessons plans for all elementary content areas and grades, *IT's Elementary!* is essential reading for K–6 teachers and administrators, technology and curriculum coordinators, library media specialists, and preservice teachers. Order now by phone, by fax, or online. Single copy price is \$37.95. ISTE member price is \$34.15. Special bulk pricing is available. Call 1.800.336.5191 or go to **www.iste.org/bookstore/**.